

Efficiency Benefits of High Performance Structured Packings

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Introduction

- Structured Packing is the Internal of Choice for Low Pressure and Low Liquid Rate Systems
- High Capacity
- High Efficiency
- Low Pressure Drop
- Proper Distribution is Critical

Mechanical Construction

- Thin Sheet Metal
- Angled Corrugation
- Textured & Perforated
- Layers are Segmented & Rotated



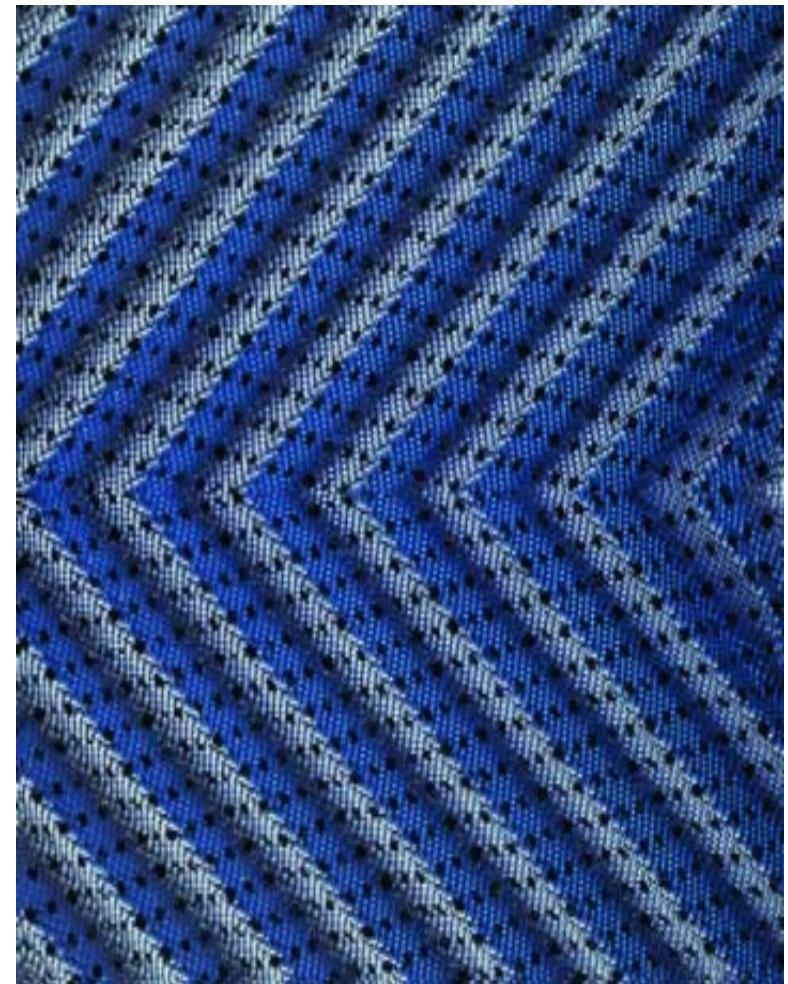
Mechanical Construction - Base Material

- Sheet Metal Typically 0.004" - 0.008"
 - Larger Crimp Packings May Require More Thickness
 - Essentially No Corrosion Allowance
 - Material Selection is Critical
- Gauze Packings Made From Woven Metal Cloth
 - Usually for Very High Efficiency Applications

- Typically Textured & Perforated
 - Texturing Promotes Spreading of Liquid on Surface
 - Perforation Allows Equalization of Flows and Pressures Between Sheets
 - Lack of Texture and/or Perforation Reduces Efficiency

Mechanical Construction - Corrugation Angle

- Most Commonly 45°
(Sulzer Y Designation)
 - Usually the Optimum Angle for Efficiency, Capacity & Cost
- Second Most Commonly 60°
(Sulzer X Designation)
 - More Often Used in Absorption & Heat Transfer Applications Where Surface Area is More Important



Mechanical Construction - Surface Area

- Typically Expressed in Units of m^2/m^3
 - Normal Range (40 - 900 m^2/m^3)
 - Benchmark M250.Y
 - Lower Surface Area Packing (40 - 90 m^2/m^3)
Often Grid Type
 - Heat Transfer & Scrubbing
 - High Surface Area $> 500 \text{ m}^2/\text{m}^3$
 - Air Separation & Fine Chemicals

When To Use Structured Packing

- System Pressure & Liquid Rates
- Vessel Diameter
- Number of Stages
- Presence of Two Liquid Phases
- Thermal Degradation

- Structured Packing Works Has its Greatest Advantage with Low Liquid Rates and High Vapor Velocities
 - In Distillation Systems, Low Pressure Means Low Liquid Rates and High Vapor Velocities. Ideal for Structured Packing
 - High Pressure Absorption with Low Liquid Rates are also Good Structured Packing Applications

Number of Stages Required

- Structured Packing's High Efficiency Makes it Ideal for Applications Requiring Many Stages
 - Exception: Superfractionators with High Pressures and High Liquid Rates

Performance Characteristics - Efficiency

- Mainly a Function of:
 - Packing Geometry
 - Surface Area
 - Crimp Angle
 - Distribution Quality
 - Process System Properties

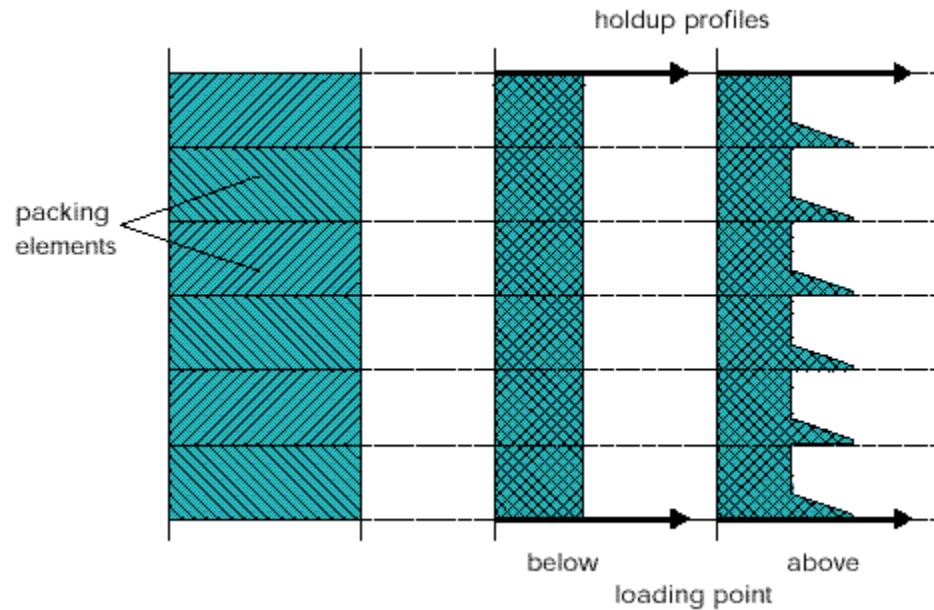
Performance Characteristics - Efficiency

- Packing Geometry
 - Surface Area: Efficiency Increases With Surface Area
 - Crimp Angle: Efficiency Increases with Decreasing Crimp Angle

Performance Characteristics - Efficiency

- Things Requiring Special Consideration:
 - High Liquid Rates
 - Rates Above 20-25 gpm/ft² May Have Lower Efficiencies
 - High Relative Volatility ($\alpha > 3$)
 - High Liquid Viscosity & High Stripping Factors
 - Absorption & Stripping Applications
 - High Surface Tension
- All These Systems Have Been Packed with Structured Packing. Special Design Considerations are Needed

Performance Characteristics - Hydraulic



- Beyond the Loading Point, Liquid Holdup in Conventional Structured Packing Begins at the Interface Between Layers

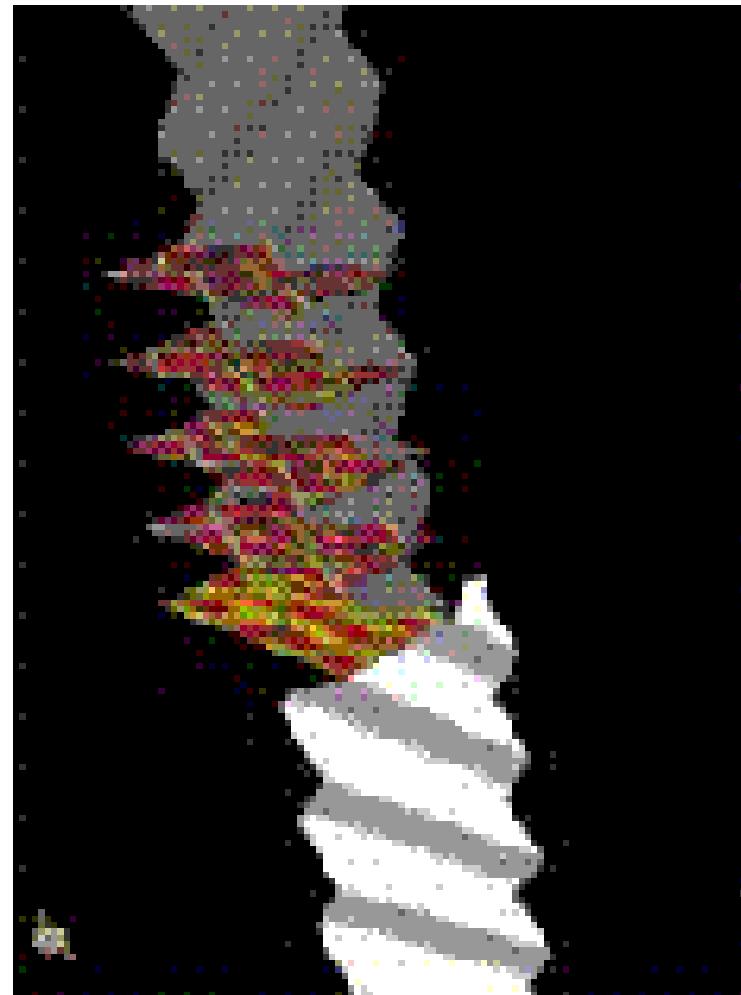
1. MellapakPlus: Background, Performances & Potential

Development steps

- ⇒ ***Concept: modify transition between the packing layers***

- ⇒ ***CFD Analysis***

- ⇒ ***Mechanical issues***

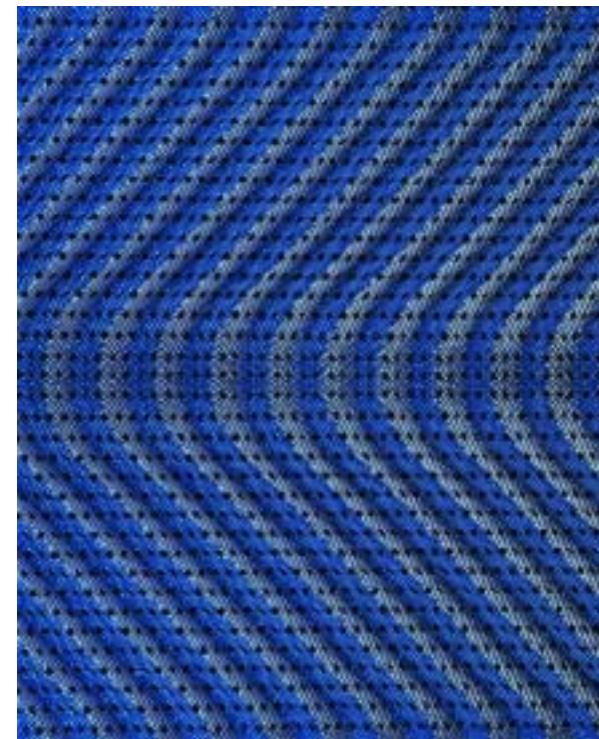


Product

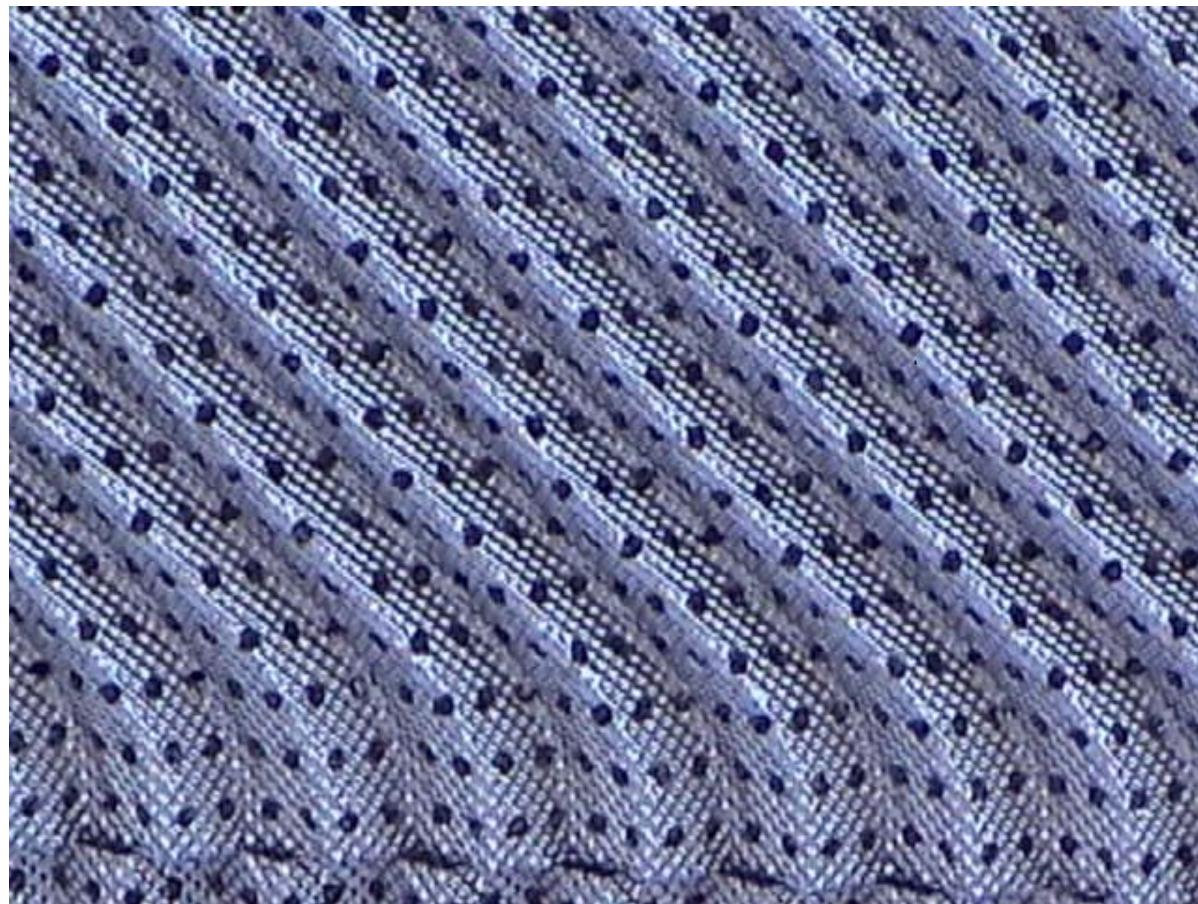
Mellapak®



MellapakPlus®



Close Up Mellapak 252.Y



Sulzer Chemtech Testing

- **Facility:** Winterthur, Switzerland
- **Column Diameter:** 3.3 ft (1 m)
- **Bed Depth:** 9.9 ft (3.03 m)
- **Distributor Type:** Sulzer Chemtech VKG
- **Test System:** Chloro/Ethyl Benzene at 75mm Hg (100 mbar)

FRI Testing

- **F.R.I. 2000 Category 1 Packing Test**
- **Industrial Scale Test Facility**
- **Measure efficiency, capacity, pressure drop, holdup**

FRI Testing

- Facility Stillwater, OK
- Column Diameter: 4 ft (1.2 m)
- Bed Depth: 12 ft (3.7 m)
- Distributor Type: Sulzer Chemtech VKG
- Test Systems: Ortho/Para-Xylene at
100mm Hg (133 mbar)

 C_6/C_7 at 5 & 24 psia
(345 & 1650 mbar)

FRACTIONATION RESEARCH, INC.
Low Pressure Column
12 feet (3.7m) Bed of Sulzer Mellapak 252.Y Structured Packing

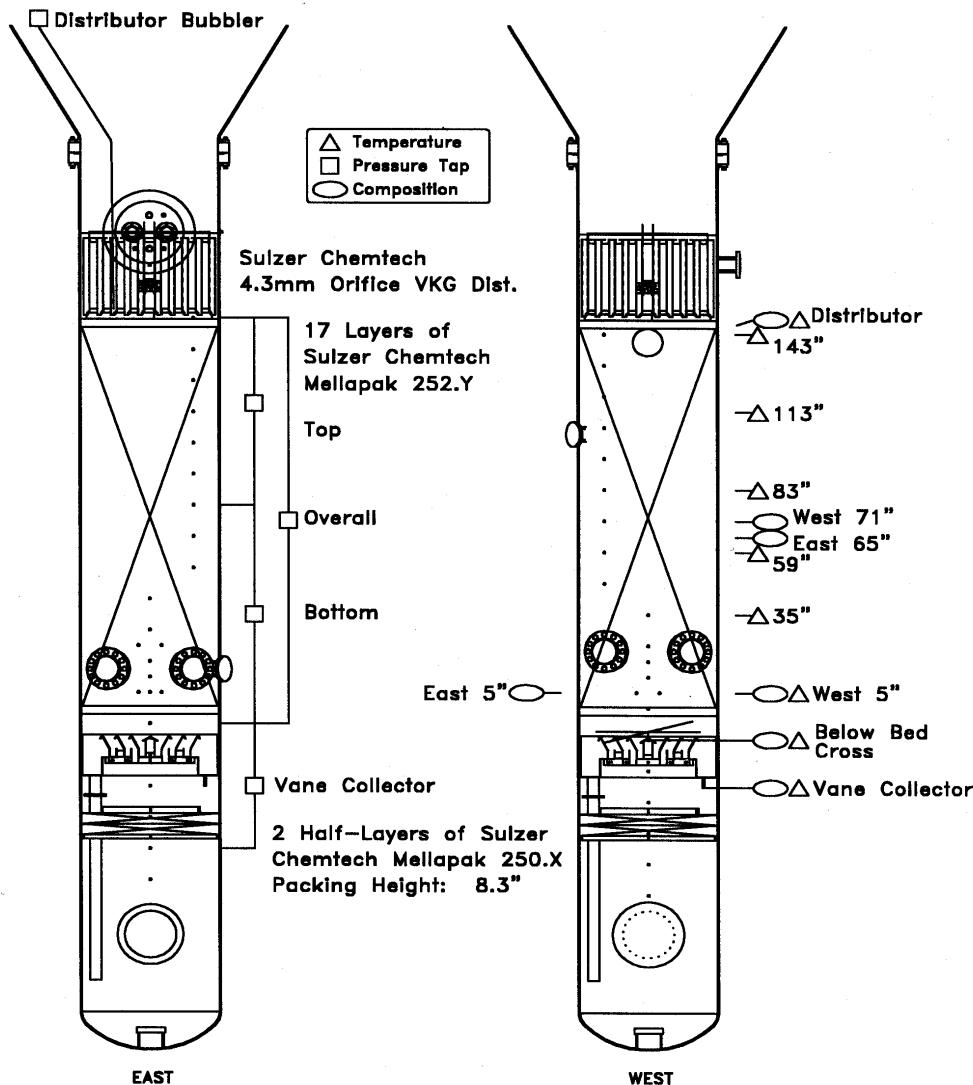


Figure 3. Mellapak Plus 252.Y Efficiency
 o/p Xylene System, 100 mm Hg (FRI)
 &
 Chloro/Ethyl Benzene, 77 mm Hg (Sulzer CT)
 Capacity Factor C_s , m/s

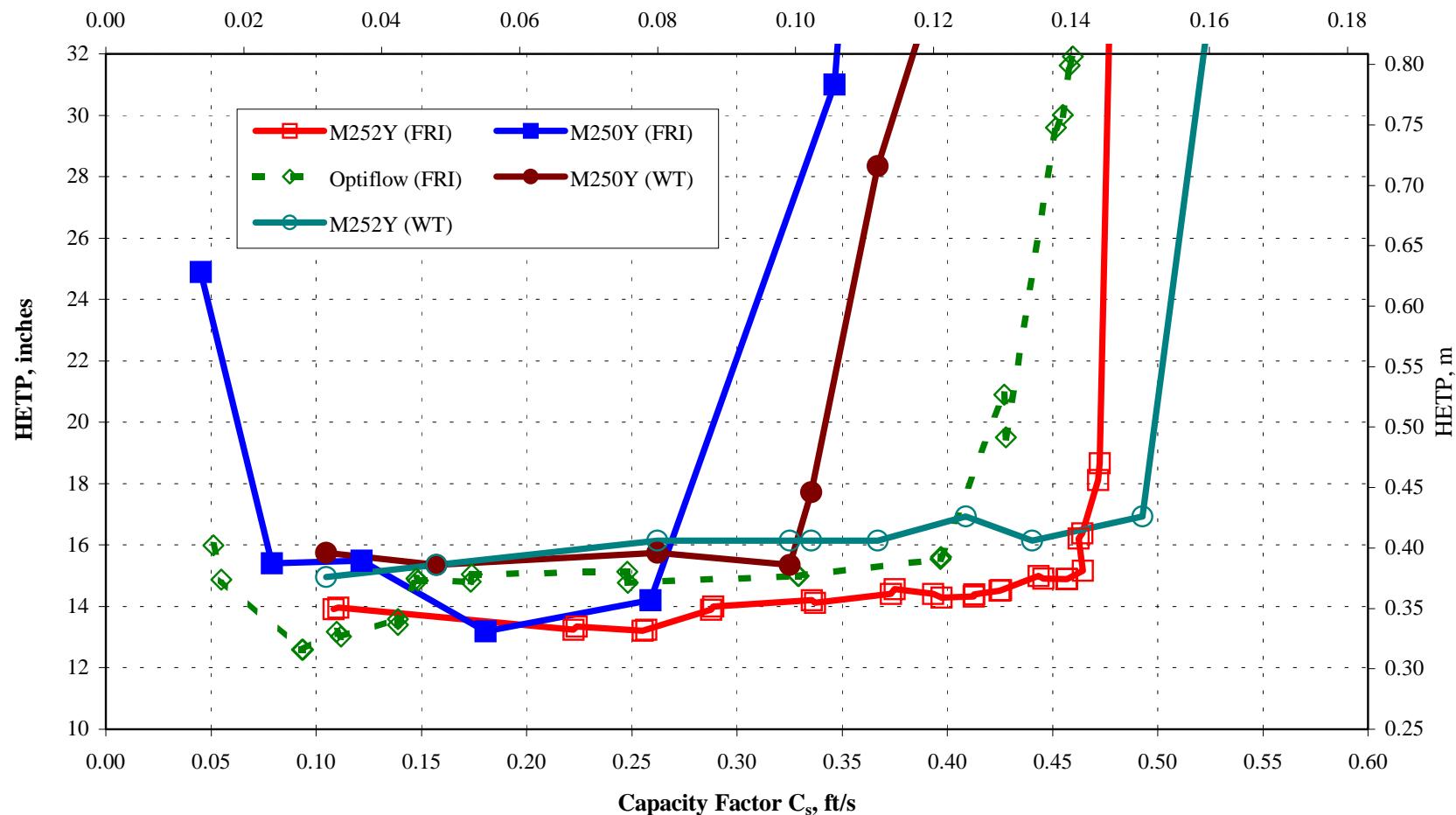


Figure 4. Mellapak Plus 252.Y Efficiency
12 foot (3.67 m) Bed Depth
C₆/C₇ System, 5 psia (0.34 bar)

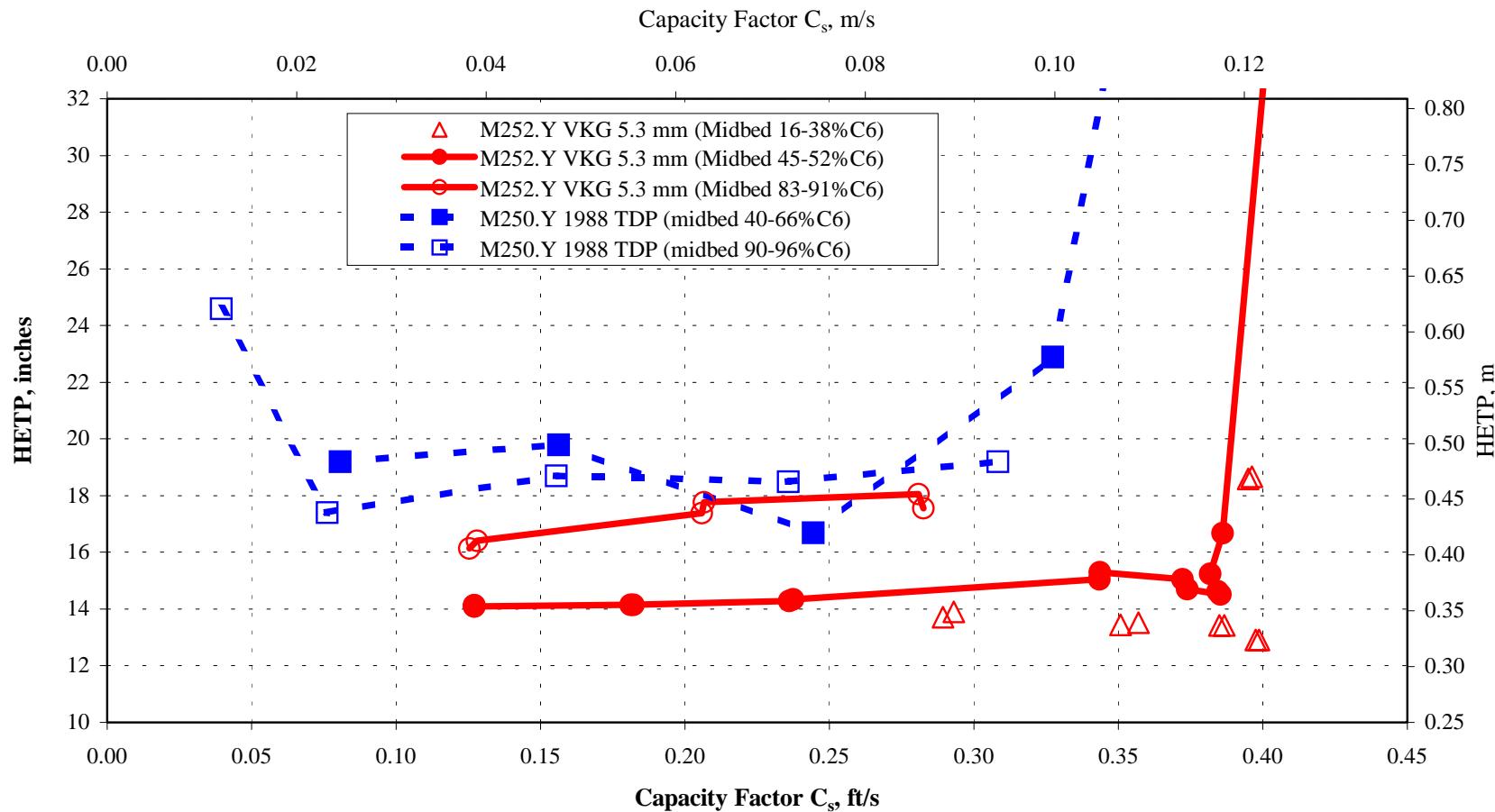


Figure 5. Mellapak Plus 252.Y Efficiency

12 foot (3.67 m) Bed Depth

C₆/C₇ System, 24 psia (1.65 bar)

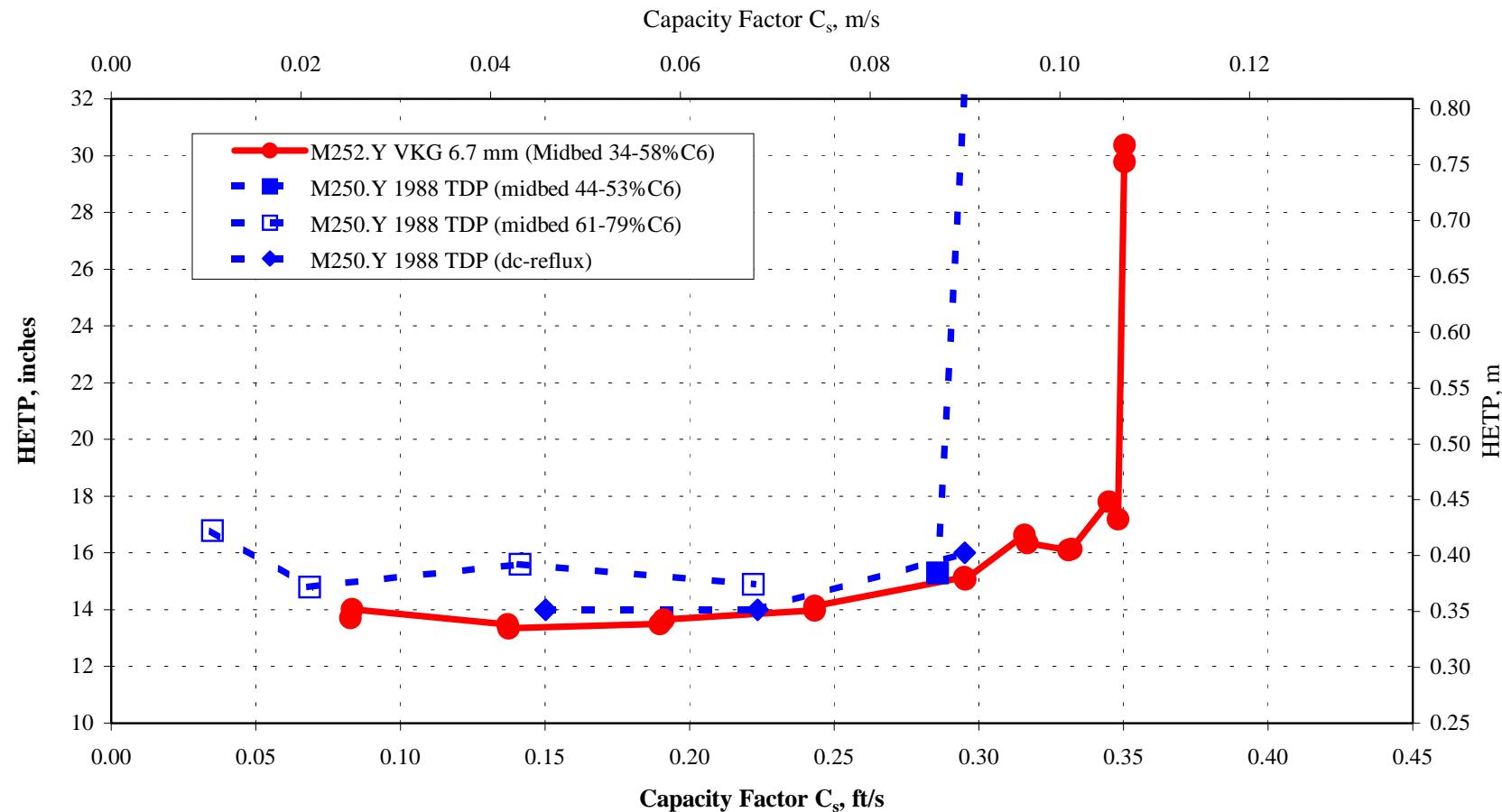
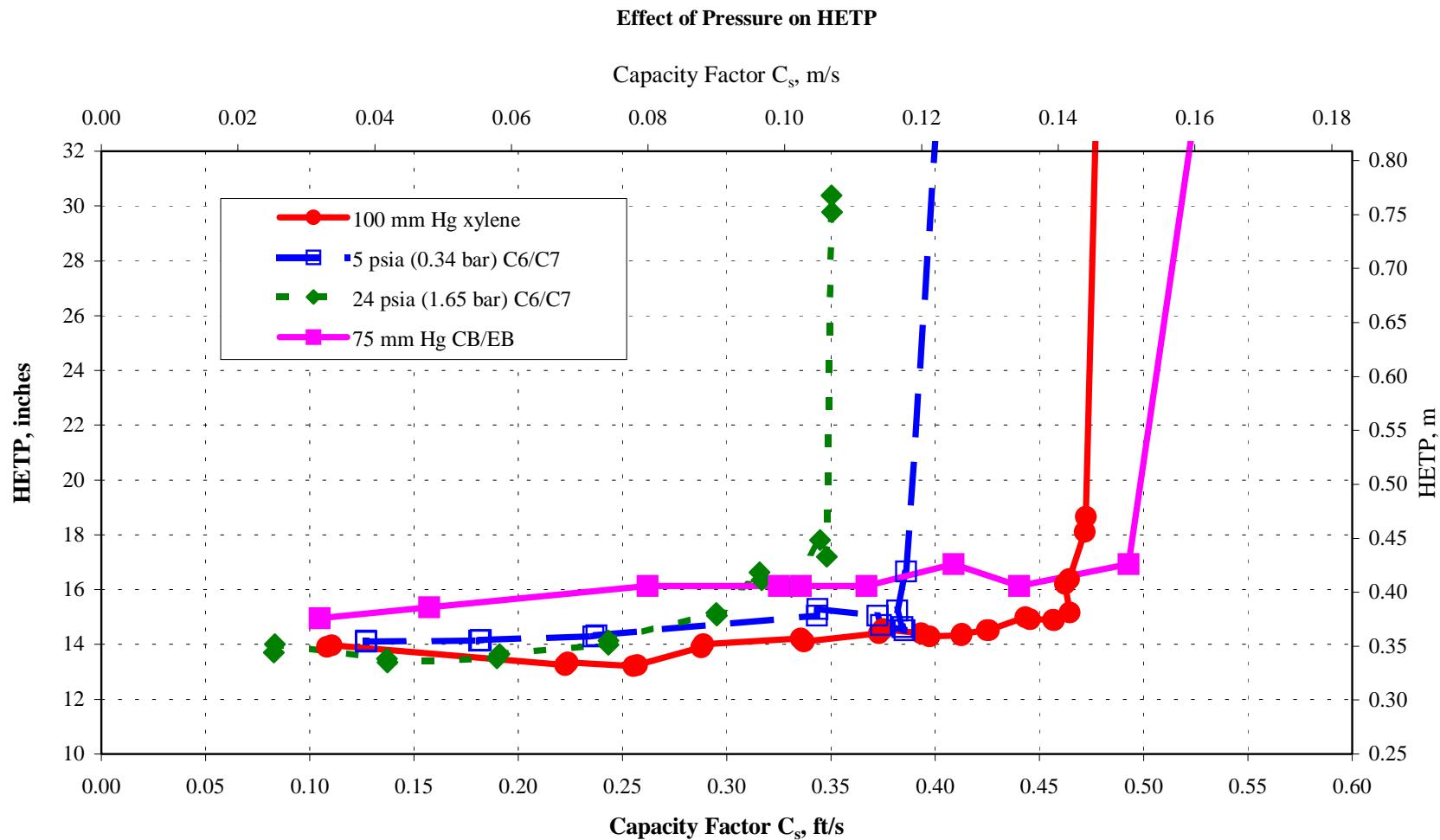


Figure 6. Mellapak Plus 252.Y Efficiency



Efficiency Conclusions

- M252.Y HETP 14 -16 inches (0.35-0.4 m) as good or better than M250.Y & Optiflow
- Maximum useful capacity 100 mm Hg: 40% above M250.Y, 15% above Optiflow
- Maximum useful capacity 5 psia (0.34 bar): 25% above M250.Y
- Maximum useful capacity 24 psia (1.65 bar): 18% above M250.Y

Figure 7. Mellapak Plus 252.Y Pressure Drop
12 foot (3.67 m) Bed Depth
o/p Xylene System, 100 mm Hg
Total Reflux

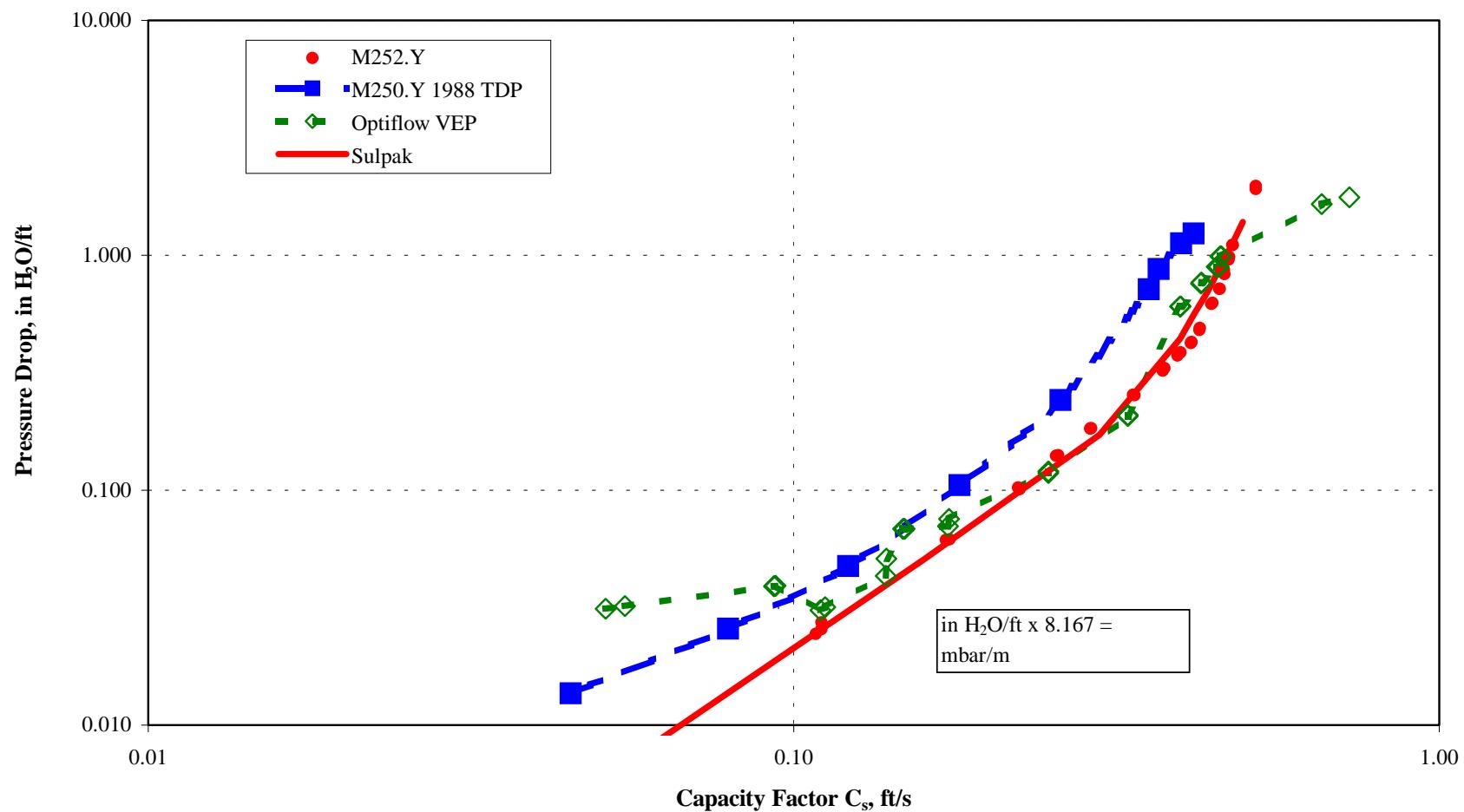


Figure 8. Mellapak Plus 252.Y Pressure Drop
12 foot (3.67 m) Bed Depth
C₆/C₇ System, 24 psia (1.65 bar)
Total Reflux

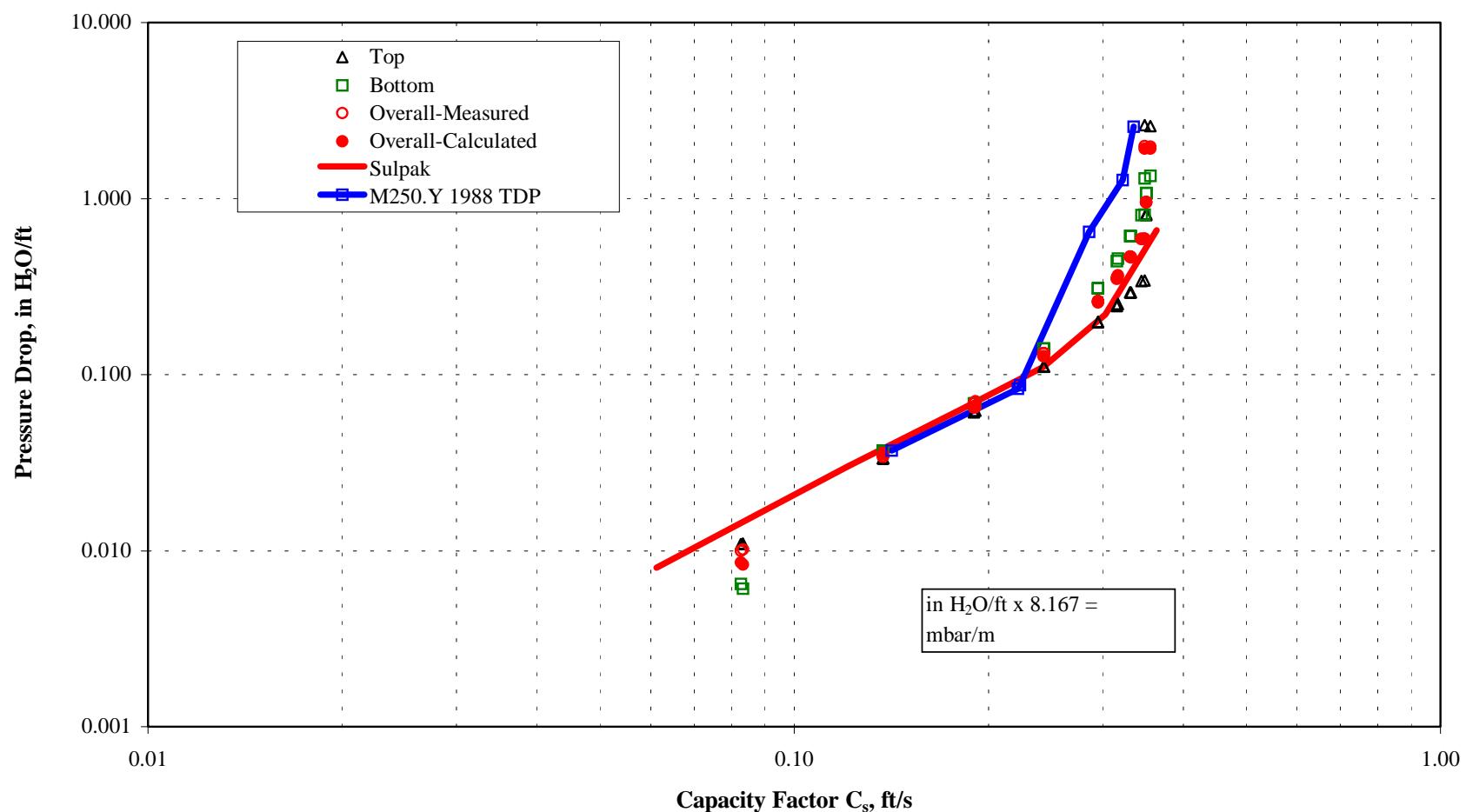
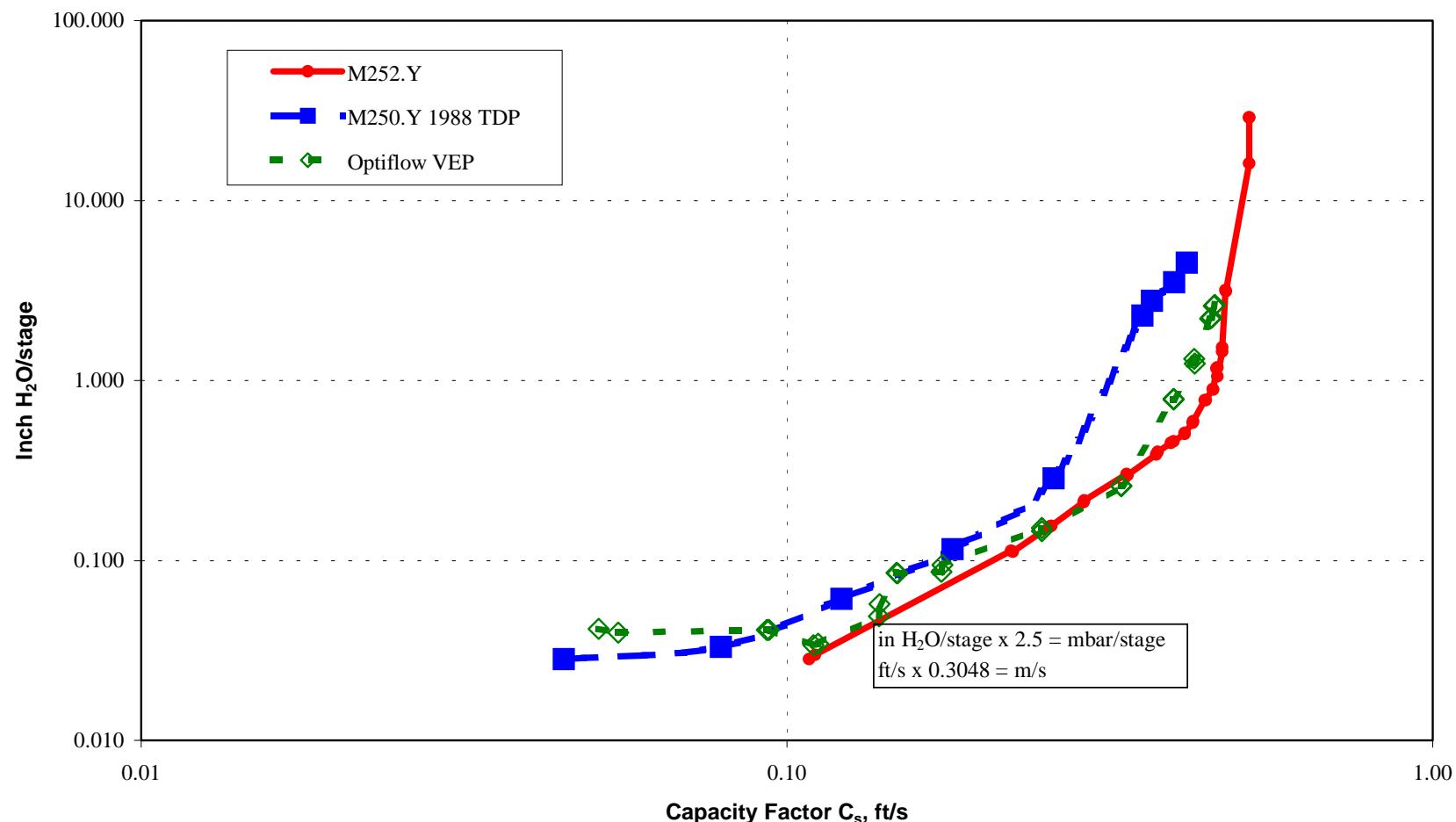


Figure 9. Mellapak Plus 252.Y Pressure Drop/Stage
12 foot (3.67 m) Bed Depth
o/p Xylene System, 100 mm Hg
Total Reflux



Pressure Drop Conclusions

- M252.Y pressure drop less than M250.Y
- Good agreement with Sulpak predictions
- Lowest pressure drop per stage measured in 100 mm Hg xylene at F.R.I.

Other MellapakPlus Data

